Brief

Research Investigation 90-019A

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BONDED PCCP OVERLAY

Route 67, Jefferson County

Research Development and Technology Division

Missouri Department of Transportation

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Project Description

Missouri's first bonded Portland cement concrete pavement (PCCP) overlay was constructed during the summer of 1990 on the northbound lanes of Route 67 in Jefferson County, from the Jefferson-St. Francois County line to 0.2 mile south of Route 110. The existing pavement consisted of 8-inch non-reinforced PCCP with sawed 20-foot non-doweled joints. The objective of this study was to gain experience in the design, construction, and performance of a bonded concrete overlay using a "fast track" high early strength (H.E.S.) paving mixture. There were 18 Missouri Test Sections (Mo.TS) located in the overlay project. This brief covers the final summary report focused solely on Mo.TS-3 through Mo.TS-13 plus two additional test sections added to the investigation since the Construction and 60-Day Survey Analysis report, published in 1990.

The 11 Mo. test sections consisted of several construction variables. The variables, as shown in Table 1, were pavement thickness, surface preparation, use of neat grout for a bonding medium and use of blankets to accelerate concrete strength gain. The pavement thickness varied from 3, 4 or 5 inches. The existing pavement surface was either shotblasted, milled-shotblasted, or milled-sandblasted. Then the pavement surface had either grout applied or not applied. Three of the Mo. test sections compared the application of blankets to contain heat.

One of the additional test sections was a 1300-foot section of the original pavement, which was widened from 2 to 4.25 feet with PCC pavement. The concrete bonded overlay was 4 inches thick with neat grout applied, and the surface preparation varied in this test section.

The second additional test section was a 400-foot section of the original pavement, which was overlayed with asphalt, at a variable thickness, to improve the sag sight distance in this area. The asphalt overlay was then milled. A 4 to 8 inch concrete overlay was then placed on top of the asphalt.

The H.E.S. bonded PCCP overlay was constructed with Type III cement to obtain a minimum compressive strength of 3500 psi in 12 hours. A neat grout, made of Type I cement and water, was sprayed directly on the pavement to enhance bonding. The 6-plus miles of pavement outside the test sections were cold milled, shotblasted and grouted before overlaying.

Table 1 – Test Section Construction Variables

Test Section	Existing Pavement Surface Preparation					Overlay Thickness				Grout Y/N	Blanket Layer
	Milled	Shot – Blasted	Sand – Blasted	Varied	Milled – Asphalt	3"	4"	5"	4 – 8"		
3		X				X				N	1
4	X		X			X				N	1
5		X				X				Y	1
6	X		X			X				Y	1
7	X		X					X		N	1
8		X						X		N	1
9	X		X					X		Y	1
10		X						X		Y	1
11	X	X					X			Y	1
12	X	X					X			Y	2
13	X	X					X			Y	0
Widened				X			X			Y	1
Milled – Asphalt				X	X				X	N	1

Observations and Conclusions

After almost 10 years of service, the concrete overlay on the milled asphalt overlay showed the best overall performance. This pavement shows the fewest number of cracks/panel. The sections with the milled-shotblasted surface preparation performed the best of the original 11 Mo. test sections. The shotblasted only surface preparation sections did not adequately provide bonding between the original pavement and the concrete overlay. The test sections Mo.TS-8 and 10 (5" Shotblasted) have shown the greater amount of moderate and high severity transverse and longitudinal cracking and almost total debonding. Mo.TS-3 (3" Shotblasted) has started to show significant increase of deterioration in the moderate severity transverse cracks and in the moderate and high severity longitudinal cracks. The test section with the widened area has shown a sharp increase in high severity transverse and longitudinal cracks since the previous pavement survey, especially in the widened portion.

With regards to overlay thickness, the test sections with an overlay thickness of 5 inches actually have shown higher severity cracking levels and larger debonding areas compared to the 3-inch overlay thickness. Overall, when considering the application of neat grout and its effect on performance, it appears to decrease the moderate and high severity transverse cracking in several of the test sections. This is most likely the result of improved bonding of the PCCP overlay to the existing pavement.

Recommendations:

Future bonded PCCP overlays, if pursued, should require the existing pavement to be milled then shotblasted and a neat grout applied.

Additional consideration and investigation should be given to studying the effects of a milled asphalt layer of considerable thickness between the original and the concrete overlay pavements, also known as "whitetopping".

Further research should be performed to study the effects of different concrete overlay thickness.